MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

TAI 2151 – ARTIFICIAL INTELLIGENCE FUNDAMENTALS

(All sections / Groups)

16 February 2023
9:00am – 11:00am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of seven pages with 5 Questions only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the answer booklet provided.

Question 1 [10 marks]

(a) What is Turing test in Artificial Intelligence? [2 marks]

(b) **Learning agent** is an agent whose behavior improves over time based on its experience. List and explain the FOUR(4) conceptual components in a learning agent. [4 marks]

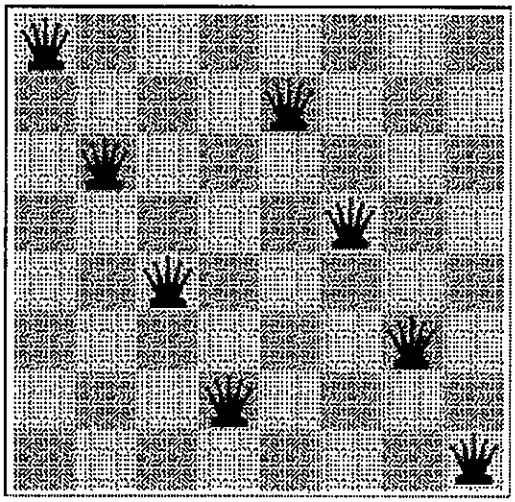
(c) Write a simple agent program. [4 marks]

Continued.....

Question 2 [10 marks]

(a) An example of heuristic search problem is the 8-queens problem. The objective is to place eight queens on a chessboard such that no queen threatens (attacks) another. A queen threatens (attacks) another queen in the same row, column or in diagonal.

Define and describe the FOUR components of the 8-queens problem.



[4 Marks]

(b) A search strategy is defined by picking the order of node expansion.

(i) Define TWO(2) evaluation criteria for a search strategy.

[1 Mark]

(ii) List and explain TWO(2) uninform search strategies.

[2 Marks]

Continued.....

Question 2 (Continued.....)

(c) **Figure 1** shows a simple minimax tree. Apply the minimax algorithm together with alpha-beta pruning to the tree. Show your solution step by step, and mark with an "X" to any node that is eliminated.

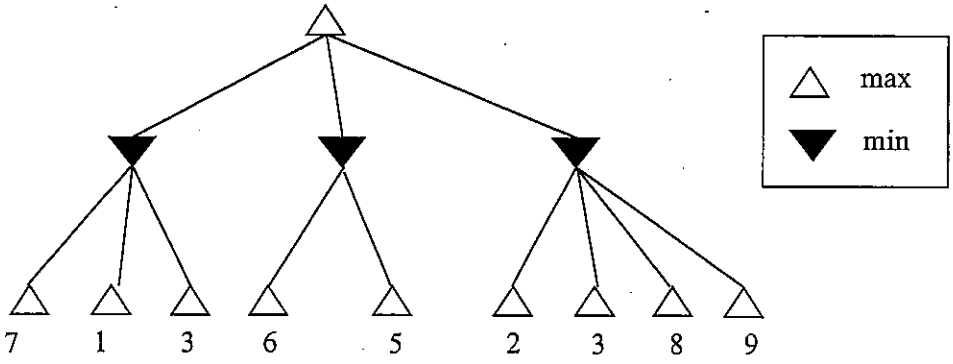


Figure 1: A Minimax Tree.

[3 marks]

Continued.....

Question 3 [10 marks]

(a) **Figure 2** shows a simplified road map of part of Melaka. Use tree diagrams to show the operations of

(i) a **greedy best-first search**, and

[2 marks]

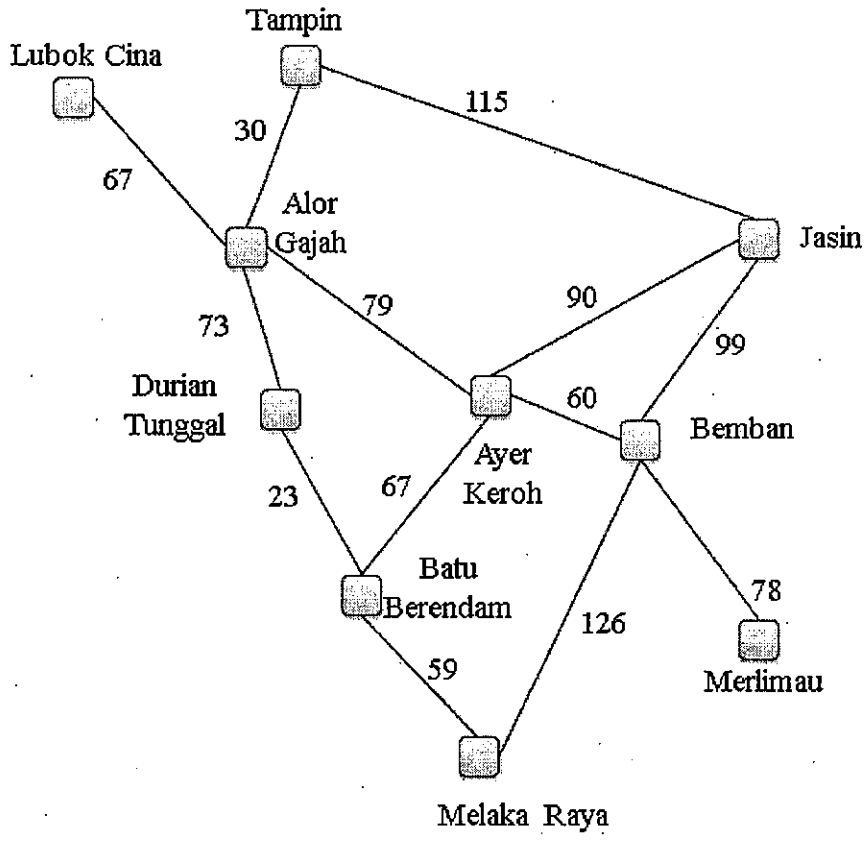
(ii) an **A* search**

[7 marks]

for the problem of getting to **Melaka Raya** from **Tampin**. Note that the **function scores** involved should be indicated clearly.

(iii) Then, discuss the performance of **greedy best-first search** and **A* search** based on the search trees produced above.

[1 mark]



Straight-line Distances to Melaka Raya:

Alor Gajah	276
Ayer Keroh	155
Batu Berendam	123
Bemban	167
Durian Tunggal	178
Jasin	299
Lubok Cina	435
Melaka Raya	0
Merlimau	99
Tampin	398

Figure 2: A Simplified Roadmap of Part of Melaka.

Continued.....

Question 4 [10 marks]

(a) By applying the equivalence rules, decide whether each of the following sentence is valid or satisfiable.

(i) $Big \vee Dumb \vee (Big \rightarrow Dumb)$

(ii) $(Big \wedge Dumb) \vee \neg Dumb$

[3 marks]

(b) Given the following statements

1. One can be successful in his business if he is hardworking, is ambitious, is generous, or is sincere.
2. Martin is not a generous businessman.
3. Martin is not a sincere businessman.
4. Martin is a successful businessman.

(i) Express these statements in a predicate calculus form.

[2 marks]

(ii) Prove that, by applying resolution refutation, Martin is either hardworking or ambitious.

[5 marks]

Continued.....

Question 5 [10 marks]

(a) What are the three types of learning? Explain.

[3 marks]

(b) Four factors (attributes) are considered by a customer to give or not a big tip in a restaurant. These attributes are the quality of food (*Food*), and the service speed (*Speed*), the price range of the restaurant (*Price*). The possible values of each attribute are listed as follows.

$$\begin{aligned} Food &\in \{\text{Great, Moderate}\} \\ Speed &\in \{\text{Slow, Fast}\} \\ Price &\in \{\text{Normal, High}\} \end{aligned}$$

A set of data samples are listed in **Table 1.**

Table 1 Data Samples.

Record ID	*Food*	*Speed*	*Price*	Give big tip?
1	Great	Fast	Normal	Yes
2	Great	Slow	Normal	Yes
3	Moderate	Fast	High	No
4	Great	Fast	High	Yes
5	Moderate	Slow	High	No

Note: $\log_2 1 = 0, \log_2 2 = 1, \log_2 3 = 1.58, \log_4 = 2, \log_2 5 = 2.32, \log_2 6 = 2.58$

Also, $\log\left(\frac{x}{y}\right) = \log x - \log y$.

(i) Use the **Information Gain method** to find out the root node of the decision tree. Show all your work.

[5.5 marks]

(ii) Draw a decision tree.

[1.5 marks]

End of Paper